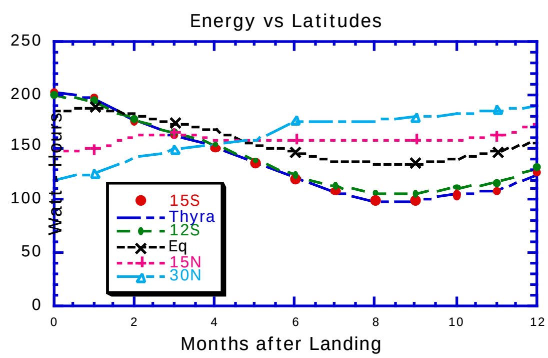
could be located far from the surface, below one kilometer of frozen breccias and sediment. Although it is absolutely necessary to reach this water in the perspective of human settlement on Mars, such depth will require techniques that might not be ready for the coming robotics (starting 2001) and first manned missions. As a transition, frost mounds could provide sites where lighter equipment could reach the necessary resources and exploit them. The main advantages of frost mounds are that: (a) the ice core can be reached by relatively shallow drilling or excavation of only a few meters of frozen lacustrine sediment, and (b) they consist of an abundant volume of ice. The example of mound No. 9, developed in Cabrol et al., (1999) shows that this mound only could provide about 450 million liters of water. The main inconvenience of frost mounds is the fact that they are a finite resource and that energy will be required to transform ice into water. However, for short term settlement, they represent a more accessible target than deep confined aquifers.

The presence of frost mounds in Gusev crater near Thyra has morphologic, geometric and climatic support. The question of their origin can be resolved by the ongoing Mars Global Surveyor Mission with high resolution imagery and infrared thermal surveys of the clusters. If the hypothesis is confirmed, it is one more critical argument to land a mission in Gusev.

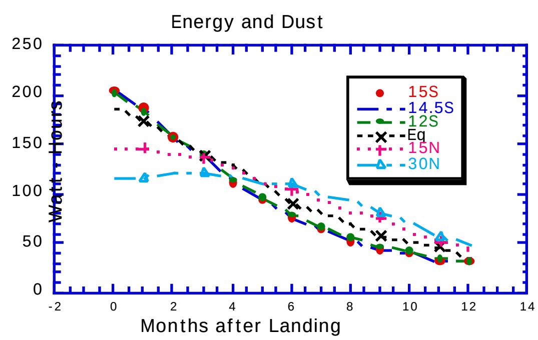
Energy and Engineering Constraints: There is in reality not much difference in energy availability level between the 12S latitudinal limit imposed by the ‘01 APEX mission and the 14.5S of the Thyra site in Gusev (see graphs 1 to 3). We support the argument that the potential scientific interest and outcome of a mission in Gusev highly exceed the possible (but not even certain) gain in mission survival time between 12 and 15S Lat. We still think that Gusev should be considered as a valuable target for the ‘01 APEX mission. In the following graphs, we show what difference in energy availability does exist for a mission considered “viable” at 12S and a mission in Gusev (15S or 14.5S) considered out of limits. We plotted our energy estimates against the values proposed by the Mars Surveyor 2001 Project, Mission Design & Navigation Team (1998), see graphs 1, 2, and 3.

Conclusion: (1) The gain in energy for the ‘01 mission is not dramatic between 12S and 15S and does not justify the rejection of excellent sites located at 15S; (2) The landing ellipse is such as 15S that it may allow oppotunity to traverse rover to any location within the landing ellipse, allowing better pre-mission planning; (3) The energy availability is better at higher latitude during the first 100 sols. There is no certainty that the rover and lander will be still alive after this period (see the Pathfinder mission). There is then a good argument to favor having most of the energy available in the primary phase of the mission. (4) The elevation of Gusev crater (unless contradicted by MOLA) is within the engineering constraints, as are the rock abundance and thermal inertia as known with Viking data; (4) the science objectives that can be met in Gusev-Thyra are highly relevant to the Mars Surveyor Program, including ‘01 and the human exploration as defined by the HEDS.

Graph 1: Rover Energy at Various Latitudes and for Gusev Delta and Thyra.



Graph 2: Rover Energy Reduced to Dust Accumulation including Gusev Delta and Thyra.



Graph 3: Lander Energy Profile at Various Latitudes, including Gusev Delta and Thyra.